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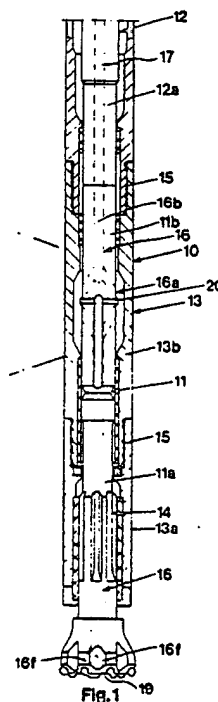
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(54) Drill bit.

(57) The present invention relates to a drill bit (11) intended to be included in a drill string (10) for top hammer drilling, said drill string (10) including a set of central rod members (12) for transferring impact energy to the drill bit (11) and a set of tubular members (13) surrounding the set of rod members (12) for transferring rotation to the drill bit (11). The invention also relates to a tubular member (13b) and to a drill string (10).

In drilling equipments of the type mentioned above it is favourable - especially for bigger diameters, preferably above 125 mm - to guide the flushing medium in an internal channel in the set of rod members (12). In order to guarantee lubrication of the splines coupling (14) through the lubricant that is mixed into the flushing medium an intermediate section (16a) of the drill bit (11) is provided with branch channels (16c, 16d) to discharge the flushing medium to a recess (18) in the space between the drill bit (11) and the set of tubular members (13).



EP 0 383 737 A1

## Drill bit

The present invention relates to a drill bit that is intended to be included in a drill string for top hammer drilling. Said drill string includes a set of central rod members for transferring impact energy to the drill bit and a set of tubular members surrounding the set of rod members for transferring rotation to the drill bit. The invention also relates to a tubular member and a drill string.

From US-A-4,094,364 a device of the above mentioned kind is previously known. The set of central rod members consists of preferably massive rods and flushing medium is fed to the drill bit via an annular space between the set of rod members and the set of tubular members. The drill bit is closed at its rear impact-receiving end. The reason for this structural design is that the transferring surface of the rods and the drill bit for the impact energy must be sufficiently big in order to make possible the use of a top hammer equipment having such a high effect that a satisfying drill penetration rate is achieved. For bigger drill hole diameters, especially exceeding 125 mm, the rod members of the set also get a bigger diameter and thereby the cross-section area of the rod members become sufficient even if an internal flushing channel is arranged. However, an internal flushing channel provides insufficient lubrication of the splines coupling between the drill bit and the tubular member and furthermore there is a risk, due to jet action, that cuttings (crushed rock) are sucked in between the drill bit and the tubular member at the front of the drill bit.

The aim of the present invention is to disclose a drill bit and a tubular member included in a drill string as described above, said drill bit and the tubular member in cooperation eliminating the problems discussed above.

The present invention is realized by a drill bit, a tubular member and a drill string that have been given the characteristics of the appending claims.

Below an embodiment of the invention will be described, reference being made to the accompanying drawings, where Fig.1 shows a partly sectioned side view of a drill string according to the invention; Fig.2 shows a detail of the drill string according to Fig.1; and Fig.3 shows a detail of an alternative embodiment of the invention.

Fig.1 shows the lower portion of a drill string 10 including a drill bit 11 according to the present invention. In the shown embodiment the drill bit 11 is in separate pieces 11a and 11b, said pieces resting loosely against each other. However, within the scope of the invention it is also possible to have an integral drill bit.

The upper portion 11b of the drill bit 11 is

brought in contact with the lowest rod 12a of the central set of rod members 12 that transfers impact energy from the top hammer to the drill bit 11. The lower end of the rod 12a rests loosely against the upper end of the upper piece 11b.

The set of tubular members 13 surrounding the set of rod members 12 and the drill bit 11 transfers rotation from the top hammer equipment to the drill bit 11. This is effected inter alia by a splines coupling 14 between the lowest tubular member 13a of the set of tubular members 13 and the drill bit 11. The tubular members of the set of tubular members 13 are connected by thread couplings 15.

As is apparent from Fig.1 the drill bit 11 is provided with a substantially central flushing medium channel 16. The set of central rods 12 has a centrally running flushing medium channel 17.

In the upper piece 11b of the drill bit 11 the substantially central flushing medium channel 16 has an intermediate section 16a that is shown in detail in Fig.2. Said section 16a is located above the splines coupling in Fig.1. As is apparent from Fig.2 a portion 16b extending from above of the central flushing medium channel 16 is divided into two branch channels 16c that are inclined relative to the longitudinal centre axis of the flushing medium channel 16. The branch channels 16c perforate the envelope surface of the upper piece 11b and emerge in an internal recess 18 in a surrounding tubular member 13b of the set of tubular members 13.

From the recess 18 two further branch channels 16d extend to a downwards directed portion 16e of the central flushing medium channel 16, said two branch channels 16d also being inclined relative to the longitudinal centre axis of the flushing medium channel 16.

The central flushing medium channel 16 extends through the lower piece 11a of the drill bit 11 and emerge via discharge channels 16f in the front face 19 of the drill bit 11.

The above described structural design of the drill bit 11 functions in the following way.

The flushing medium is normally air having a mixed in lubricant, e.g. in the form of oil. When the flushing medium flowing towards the drill bit 11 passes the section 16a of the central flushing medium channel 16, said flushing medium will via the branch channels 16c emanate into the recess 18 and from there via the branch channels 16d to the downwards directed portion of the central flushing medium channel 16 to continue towards the front face 19 of the drill bit 11. When the flushing medium passes the recess 18 lubricant will adhere

to the surfaces of the recess 18 and then said lubricant will trickle down into the space between the drill bit 11 and the set of tubular members 13. This means that the splines coupling 14 between the lower piece 11a of the drill bit 11 and the lowest tubular member 13a of the set of tubular members 13 automatically gets a proper lubrication.

A further advantage of the structural design according to the present invention is that a pressure equalization takes place regarding the central flushing medium channel 16 and the space between the lower piece 11a of the drill bit 11 and the lowest tubular member 13a of the set of tubular members 13. Since the pieces 11a and 11b resp. of the drill bit 11 loosely rest against each other with an accompanying play, jet action from the flowing flushing medium might create a certain partial vacuum between the drill bit 11 and the set of tubular members 13. Such a partial vacuum could lead to that cuttings being sucked in from below between the lower piece 11a of the drill bit 11 and the lowest member 13a of the set of tubular members 13. This would inter alia damage the splines coupling 14. The arrangement of the section 16a eliminates the risk for creation of a partial vacuum of the type described.

In the area of the section 16a the upper piece 11b of the drill bit 11 is provided with a travel limiter 20 preventing said piece from sliding out when the lower piece 11a of the drill bit 11 is removed for exchange or service.

The alternative embodiment of Fig.3 includes a through-going central flushing medium channel 16 being provided with a throttling 21. The portion 16g in Fig.3 located above the throttling 21 of the flushing medium channel 16 has a bigger diameter than the portion 16h of the flushing medium channel 16 located below the throttling 21.

Before the throttling 21, seen in the direction of flow of the flushing medium, a transverse channel 22 is provided. Said channel 22 extends from the portion 16g of the flushing medium channel 16 and penetrates the envelope surface of the drill bit 11. The transverse channel 22 emanates in an internal recess 18 in a surrounding tubular member 13b of the set of tubular members 13.

The structural design shown in Fig.3 functions in principle as the embodiment described in connection with Figs.1 and 2.

The invention is in no way restricted to the embodiments described above but can be freely varied within the scope of the appending claims.

## Claims

1. Drill bit (11) intended to be included in a drill

string (10) for top hammer drilling, said drill string (10) including a set of central rod members (12) for transferring impact energy to the drill bit (11) and a set of tubular members (13) surrounding the set of rod members (12) for transferring rotation to the drill bit (11),

**characterized** in that the drill bit (11) has a central longitudinal flushing medium channel (16), and that at least one transverse channel (16c,16d;22) is provided in an intermediate section (16a) of the drill bit (11), said transverse channel (16c,16d;22) being connected to the central flushing medium channel (16) and perforating the envelope surface of the drill bit (11).

2. Drill bit according to claim 1,

**characterized** in that the portions (16b,16e) of the central flushing medium channel (16) located axially on each side of the intermediate section (16a) have at least one branch channel (16c,16d) each, said branch channels constituting the transverse channels in the intermediate section (16a).

3. Drill bit according to claim 1,

**characterized** in that the central flushing medium channel (16) is through-going and has a throttling (21) in the intermediate section (16a), and that the portion (16g) being located before the throttling (21) viewed in the flowing direction of the flushing medium has a bigger cross-section area than the portion (16h) being located after the throttling (21), said transverse channel (22) being connected to the portion (16g) being located before the throttling (21).

4. Drill bit according to claim 4,

**characterized** in that the drill bit is in separate pieces, said pieces (11a,11b) resting loosely against each other.

5. Drill bit according to claim 4,

**characterized** in that the parting plane is located between the intermediate section (16a) and the front face (19) of the drill bit (11).

6. Tubular member (13b) being included in a set of tubular members (13), said set being intended to be included in a drill string (10) for top hammer drilling, said drill string (10) including a set of central rod members (12) for transferring impact energy to the drill bit (11), and that the set of tubular members (13) surrounds the set of rod members (12) for transferring rotation to the drill bit (11),

**characterized** in that the tubular member (13b) has an internal recess (18).

7. Drill string for top hammer drilling including a drill bit (11) and a set of central rod members (12) for transferring impact energy to the drill bit (11) and a set of tubular members (13) surrounding the set of rod members for transferring rotation to the drill bit (11),

**characterized** in that the set of central rod mem-

bers (12) has a central, longitudinal, continuous flushing medium channel (17), and that the drill bit (11) has a central, longitudinal flushing medium channel (16b,16e), and that in an intermediate section (16a) of the drill bit (11) at least one transverse channel (16c,16d) is provided, said channel being connected to the central flushing medium channel (16) and perforating the envelope surface of the drill bit (11), and that axially in the level with the transverse channel (16c,16d) the set of tubular members (13) is provided with an internal recess (18).

8. Drill string according to claim 7, **characterized** in that the portions (16b,16e) of the central flushing medium channel (16) of the drill bit (11) located on each side of the intermediate section (16a) have at least one branch channel (16c,16d) each, said channels constituting the transverse channels in the intermediate section (16a).

9. Drill string according to claim 8, **characterized** in that the branch channels (16c,16d) are inclined relative to the longitudinal centre axis of the drill bit (11).

10. Drill string according to any one of the claims 7-9, **characterized** in that the drill bit (11) is in separate pieces and in the area of the intermediate section (16a) has a travel limiter (20) that is intended to cooperate with the set of tubular members (13) to guarantee a limited axial displacement of the upper piece (11b) of the drill bit (11) relative to the set of tubular members (13).

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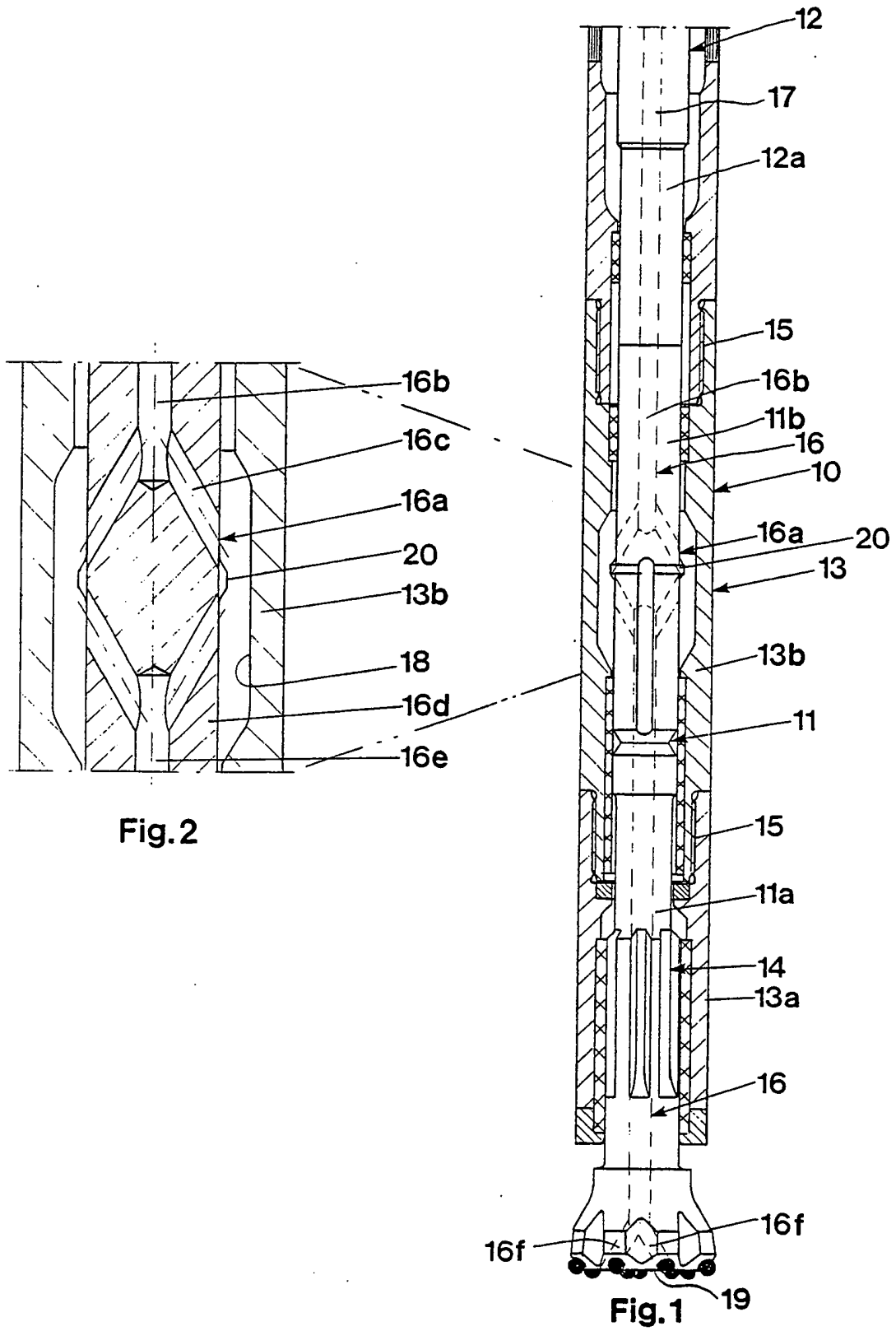
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# EUROPEAN SEARCH REPORT

Application Number

EP 90 85 0051

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	US-A-4 094 364 (LUNDSTROM et al.) * Whole document * -----	1	E 21 B 21/00 E 21 B 10/38
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E 21 B E 21 C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15-05-1990	Examiner RAMPELMANN K.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

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